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ABSTRACT

Project Kaleidoscope began in 1989, with support from the National Science Foundation, with the goal of strengthening undergraduate science and mathematics programs across the country. Through workshops and publications it focuses on all aspects of the undergraduate environment including faculty, curriculum, facilities, and institutional issues. The workshops bring faculty with their administrative colleagues together from all sectors of higher education across disciplinary lines to explore what works in strong undergraduate programs. This report on Project Kaleidoscope includes information about the project, the institutions and people involved, important issues and activities, and future plans. (JRH)

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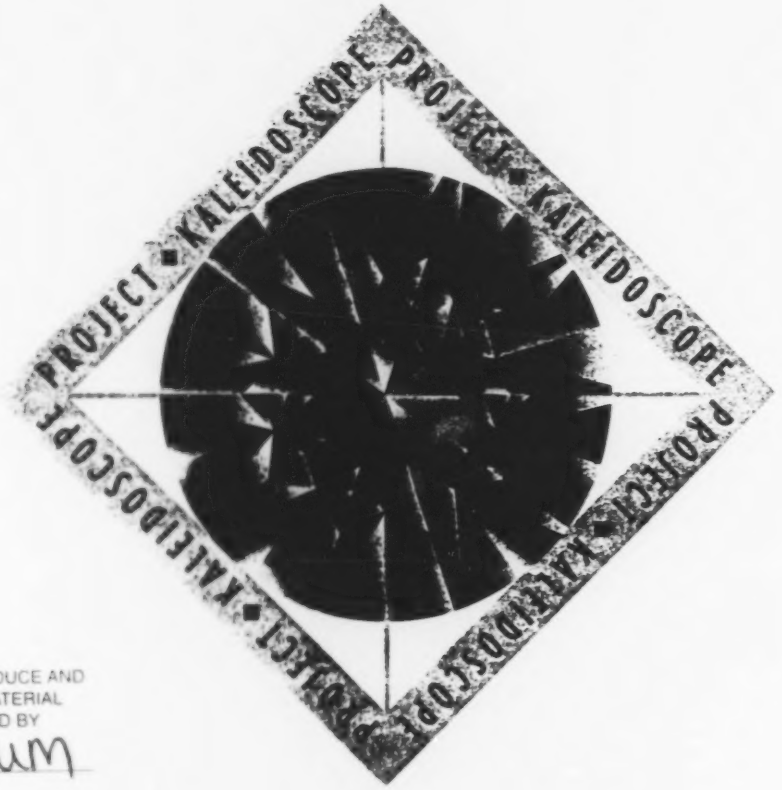

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Report on Project Kaleidoscope

1992-1996

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April 1996

Dear Colleague:

This is a report on Project Kaleidoscope: what it is, who is involved, the issues and activities that are important to us and some of our plans for the future as we continue our efforts toward strengthening undergraduate science and mathematics programs across the country.

If you are involved in PKAL, we hope the ideas and reports that we've included here encourage continued activity on your campus. Please note the agenda for PKAL work-shops and assembly during the remainder of 1996, including deadlines for the Keck/PKAL Consultant Program and for Faculty21 activities.

We also want to use this brochure to introduce PKAL to those who know nothing about us. Let me begin with some facts:

- Our work is kaleidoscopic: in workshops and publications, we give attention to all aspects of the undergraduate environment—faculty, curriculum, facilities and to institutional issues.
- Our workshops bring faculty together across disciplinary lines, from all sectors of higher education, with their administrative colleagues to explore what works in strong undergraduate science programs. We've sponsored 36 workshops, with almost 500 institutions sending teams to one or more of these.
- Teams leave workshops with a plan of action: an agenda for how to begin local reforms of curriculum and teaching; begin and sustain programs of student/faculty research; and plan, design and build new and renovated facilities supportive of science communities.
- We are identifying and helping a new generation move into leadership positions on their campuses and in the larger community through the PKAL Faculty for the 21st Century.
- From our initial base made up primarily of independent liberal arts colleges, we have found colleagues and partners in other kinds of institutions—public and private, large and small—equally committed to getting science education right.
- We began in 1989 with support from the National Science Foundation. We continue to receive NSF support as well as grants from the Fund for the Improvement of Postsecondary Education (U.S. Department of Education), the W.M. Keck Foundation, the Exxon Education Foundation, the Research Corporation and the Camille and Henry Dreyfus Foundation, Inc.

There is still much to do. PKAL has some exciting plans for the next months and years, and we hope to be working with you as we develop and implement them.

Cordially,

Daniel F. Sullivan, Chair—PKAL Executive Committee

FOCUSING ON FACULTY

1992 - 1995

Faculty:

- Over 2000 faculty have participated as a member of an institutional team at one or more PKAL workshops
- 275 faculty have presented case studies and plenary sessions at PKAL workshops

PKAL Faculty21

- 10/94: 150 members of the PKAL Faculty for the 21st Century (Class of '94) joined 50 mentors in Atlanta to discuss issues relating to setting and achieving professional goals
- 11/95: 230 members of the PKAL F21 Class of '94 and Class of '95 joined 50 mentors in Minneapolis to address the question: "what do all students need to know about the disciplines of science and mathematics before they graduate?"

"The PKAL F21 network has given me the support and courage I needed to attempt to bring a change in the way we teach physics here. Last year's PKAL meeting showed me that there are a lot of people interested in change, and that a lot of us are facing similar challenges. Talking to people who are making changes was a big help. Also, attending a PKAL Physics Workshop gave me many ideas about specific changes I can make, with data on their effectiveness in other settings. I think I am starting to have an effect on my colleagues now."

—Member, F21 Class of '94

BACKGROUND. To spark and sustain curricular renewal at the local level, faculty need to be actively involved in the same kind of intellectual community that characterizes the research community—an intellectual community that focuses on improving the learning environment for students. To achieve this, faculty need repeated opportunities for intense discussion with like-minded individuals on their own campus and from other campuses, time to identify critical issues, the opportunity to explore and experience *what works* in strong undergraduate programs today.

In its workshops, PKAL challenges faculty to think beyond the question of ownership and respond to *what works* in other settings and consider how they might adapt for their own students some of the successful practices being developed by peers.

Teams of faculty and administrators are encouraged to attend PKAL workshops, an opportunity to have extended discussions about new approaches to teaching and learning with colleagues across disciplinary lines, from other sectors and at other career stages. These are true "hands-on" workshops; each team leaves having prepared a specific agenda for action to implement at their campus.

PKAL FACULTY21. PKAL is establishing a network of faculty who are in the early stages of their career, persons who have been identified by their deans and faculty colleagues with the potential to play a leadership role in undergraduate science at the local and national level during the next century.

Faculty at all career stages are involved with PKAL; however, we are giving particular attention to younger faculty through the network of PKAL Faculty for the 21st Century (F21). Broad efforts toward curricular reform now underway will have a short life if the vision of *what works* is not owned by the next generation of faculty leaders.

With support from the Exxon Education Foundation, PKAL F21 members benefit from an expanded range of professional connections. They receive complimentary registration at PKAL workshops and copies of PKAL publications. At the annual National F21 Assembly, they have an opportunity to meet with some of today's reflective leaders and practitioners in academic science and in national educational and scientific affairs.

Each year we add a new class to the F21 network and our goal, by the turn of the century, is to have a group of leaders that are prepared to take charge of the future of undergraduate science.

Agnes Scott College ♦ Albion College ♦ Albright College ♦ Alfred University ♦ Allegheny College ♦ Alma College ♦ Amherst College ♦ Ana G. Mendez University System (PR) ♦ Aquinas College ♦ Ashland University ♦ Assumption College ♦ Augsburg College ♦ Augustana College (IL) ♦ Aurora University ♦ Austin College ♦ Baldwin-Wallace College ♦ Ball State University ♦ Barber-Scotia College ♦ Bates College ♦ Baylor University ♦ Bellarmine College ♦ Beloit College ♦ Bemidji State University ♦ Benedict College ♦ Bennett College ♦ Berea College ♦ Berry College ♦ Bethany College (KS) ♦ Birmingham Southern College ♦ Boston College ♦ Boston University ♦ Bowdoin College ♦ Brown University ♦ Bryn Mawr College ♦ Bucknell University ♦ Butler University ♦ California Institute of Technology ♦ California State Polytechnic University-Pomona ♦ California State University-Chico ♦ California State University-Fullerton ♦ California State University-Long

WHAT WORKS: REPORTS FROM F21 MEMBERS

The PKAL F21 network fosters *natural science communities* that PKAL advocates. When asked about their most exciting activities, F21 members report that:

- *During the past year, we've formed an interdisciplinary research team and have secured several major grants to support the involvement of undergraduate students in our work. We've developed interdisciplinary case studies to use with our students, challenging them to examine topics from different perspectives.*
- *I'm trying to incorporate problem-based learning into my classes as much as I can and now have at least one group problem-solving activity in each class session. The success varies, depending to a large degree on how well I designed the problem, but it is exciting to see students coming to understand the concepts behind what they are learning, and to work as a group to solve problems which, at first glance, they thought were unsolvable.*
- *Team-teaching with a master teacher has been exciting. My mentor and I both attend all classes and take turns teaching, depending on the topic. Team-teaching is not any less work than doing it solo, but it was fun and by working with a seasoned teacher, I have been able to benefit from her experience and now use, in all my classes, many new teaching techniques that I learned from her.*
- *Our department recently agreed (for the first time) to use a common text for introductory biology. We are meeting regularly to share ideas and concerns, discussing not only course content but techniques for effective teaching. We are in the process of collating a collection of lab experiments to support the course, and this will make it easier for adjunct faculty and technicians to set up labs more easily.*

We've set the deadline for nominations for the Class of '96, who will join members of the Classes of '94 and '95 in Kansas City in October, and for applications from current classes.

At their request, we are setting up a mechanism for short-term exchanges for F21 members within the PKAL community—the F21 Visiting Scholars Program. Another means to build a supportive environment for faculty at the early stage of their career is the F21 Dean's Dialogue, which makes use of the PKAL Internet Link.

1996

F21 Events:

- Faculty21 Summer Institute (by invitation): June 8-13
- F21 members present at Biennial Meeting—Council on Undergraduate Research: June 28-30
- 1996 F21 National Assembly—Kansas City (MO) "Exploration and Discovery: Scholars and Leaders." Guest: Dr. Bruce Alberts—President, National Academy of Sciences

Deadlines for Assembly:

Nominations for the F21 Class of '96: June 1

Registration for the National Assembly, F21 Classes of '94 & '95: July 1

Ongoing F21 Activities:

- The PKAL F21Visiting Scholars Program
- The PKAL F21 Dean's Dialogue

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Workshops:

- *Introductory Courses:*
  7/93—Bryn Mawr College
  8/93—Beloit College
- *Introductory Biology:*
  4/95—University of Oregon
- *Introductory Physics:*
  7/95—Miami University-Ohio
- *Interdisciplinary-Neuroscience:*
  7/95—Davidson College
- *Introductory Mathematics:*
  8/95—Mount Holyoke College
- *Introductory Chemistry:*
  9/95—Hendrix College
  3/96—Columbia University
- *The Research-rich Environment:*
  10/95—Harvey Mudd College
- *Earth and Planetary Sciences:*
  2/96—Franklin and Marshall College
- *Science for All Students:*
  4/96—Skidmore College

50 Programs That Work identified

"What I learned was that it might not be necessary to teach 'everything' and that it might be better to focus more on the process of science!"

—Workshop participant

BACKGROUND. Workshops focused on *what works* are the core of PKAL. They are an opportunity for institutional teams to come together, usually during a weekend, to develop a plan of action based on ideas gained from sessions in which experienced reformers present what works for them.

These workshops are structured around discussions of current reforms illustrating the PKAL vision of *what works*, programs that:

- are experiential, hands-on and steeped in investigation from the first courses for all students through upper-level courses for majors;
- promote learning that is personally meaningful to students, makes connections to other fields, is embedded in the context of its own history and rationale and suggests practical applications related to the student's experience; and
- take place in a community where faculty are committed equally to teaching and to their own intellectual vitality, where faculty see students as learning partners and where students collaborate with one another and gain confidence in their abilities.

What works is when institutions have the people in place to bring such programs to life, and have the facilities that accommodate them.

AIMS AND OBJECTIVES. PKAL workshops are planned and led by individuals who understand the questions to be asked and the issues to be addressed as faculty and other members of the campus community work to improve the learning environment for their students.

At the workshops, through case studies, plenary presentations and small group consultations, participants explore many different issues:

- what and how to teach from the disciplinary perspective;
- institutional and departmental barriers to reform;
- appropriate spaces for new pedagogical approaches; and
- the impact of reforms.

Building a local environment that encourages planning, fosters creativity and rewards useful innovation are themes woven into all workshop sessions.

To prepare for workshop sessions, teams come with a poster illustrating current activities on their campus. During the workshop, each team, working with an assigned facilitator, prepares a plan that serves as a template for action and future planning. This emphasis on action is a distinguishing feature of PKAL workshops.

You can find materials from PKAL events on the PKAL Internet, and we are developing home pages for each of the topical areas that serve as workshop themes. Ultimately, these will include reports on the continuing reform efforts at the local level.

Dame of Maryland ♦ College of Saint Francis ♦ College of Saint Benedict ♦ College of Saint Catherine ♦ College of Saint Scholastica ♦ College of Wooster ♦ College of the Holy Cross ♦ College of the Sequoias ♦ Colorado College ♦ Columbia University ♦ Columbia University-Lamont-Doherty ♦ Concordia College ♦ Concordia University ♦ Connecticut College ♦ Cornell University ♦ Cottey College ♦ Cumberland College ♦ Dartmouth College ♦ Davidson College ♦ DePauw University ♦ Deakin University (Australia) ♦ Denison University ♦ Dickinson College ♦ Dillard University ♦ Doane College ♦ Dr. Martin Luther College ♦ Drake University ♦ Drew University ♦ Drexel University ♦ Drury College ♦ Duke University ♦ Dundalk Community College ♦ Earlham College ♦ East Carolina University ♦ Eastern Michigan University ♦ Eastern Oregon State College ♦ Eckerd College ♦ Edgewood College ♦ Elmira College ♦ Elon College ♦ Emory and Henry College

ISSUES ADDRESSED. Although some questions addressed in PKAL workshops are discipline-specific, there are fundamental ones that the larger campus community must give attention to in making decisions about priorities—about using people, dollars, space and time most productively—in the context of the institutional mission, if reforms are to take root and flourish.

Some of these are:

- The disciplines are vibrant and ever-expanding; it is impossible to teach everything. What are the essential disciplinary concepts that students who become our majors, major in other sciences or other fields must understand?
- How can we satisfy the needs of all students at the introductory level? Does one size fit all? (Must introductory physics courses be calculus-based?) What can be done to ensure that introductory courses are intellectually challenging?
- How far can we shift the focus of undergraduate education from descriptive information (how many rocks can your students identify?) to the development of a framework of principles and problem-solving, based on "laws" of nature?
- What kind of laboratory experiences best facilitate student interest in chemistry research and give a solid grounding in the fundamentals?
- What are the trade-offs between large and small classes? Are there things that can be accomplished in small groups that cannot be done in large ones? What works well in both?
- How do we measure the impact of new approaches—on students, on the character of graduates, on the institutional budgets, on admissions and on faculty workload?

Over the past three years, PKAL has identified 50 *Programs That Work*, programs that provide illustrative examples of innovative ways to address the above questions, practices that are mature enough to have documented success, and that are transferable. The PKAL Internet Link includes case studies from the PKAL *Programs That Work*.

In 1996, the call for PKAL *Programs That Work* will focus on institutions that are taking seriously the challenge to "ramp-up" reforms—to institutionalize programs and approaches that have proven to be successful in a single department. We hope to learn how colleges and universities are undertaking new approaches: to faculty development; to the reallocation of resources; to developing strategic planning documents; and to assess the impact of such reforms over the long-term.

1996

Workshops:

- *The Research-rich Environment:* May 10-12/96—Hope College
- *Mathematics and Computer Science:* July 19-21/96—University of Iowa
- *Science for All Students:* July 26-28/96—St. John's-Santa Fe
- *Under-represented Minorities:* August 1-3/96—Fort Lewis College
- *Interdisciplinary/Environmental Studies:* October 25-27/96—Colby College
- *Introductory Physics:* November 15-17/96—Louisiana State University
- *Introductory Biology:* 12/96—Morehouse College TBA

Publications:

- 6/96: PKAL Occasional Paper: *Templates for an Undergraduate Neuroscience Program* (in conjunction with FUN—Faculty for Undergraduate Neuroscience)
- 6/96: PKAL Occasional Paper: *Research in the Undergraduate Setting: A Must for Students and Faculty* (in conjunction with the Council for Undergraduate Research)
- Ongoing—World Wide Web Home Pages for PKAL Workshops, featuring speakers, presentations, team posters and follow-up discussions

PKAL Programs That Work: July 15, 1996—Deadline for Proposals

♦ *Erskine College* ♦ *Evangel College* ♦ *Evergreen State College* ♦ *Fairfield University* ♦ *Fairleigh Dickinson University* ♦ *Ferris State University* ♦ *Fisk University* ♦ *Florida Community College-Jacksonville* ♦ *Florida State University* ♦ *Fordham College-Lincoln Center* ♦ *Fordham University* ♦ *Fort Lewis College* ♦ *Franklin and Marshall College* ♦ *Franklin College (IN)* ♦ *Furman University* ♦ *Gannon University* ♦ *Georgetown University* ♦ *Georgia Southern University* ♦ *Gettysburg College* ♦ *Gonzaga University* ♦ *Goshen College* ♦ *Grand Valley State University* ♦ *Grinnell College* ♦ *Gustavus Adolphus College* ♦ *Hamilton College* ♦ *Hamline University* ♦ *Hampshire College* ♦ *Hanover College* ♦ *Hartwick College* ♦ *Harvard University* ♦ *Harvey Mudd College* ♦ *Haverford College* ♦ *Hazard Community College* ♦ *Hendrix College* ♦ *Hiram College* ♦ *Hobart and William Smith Colleges* ♦ *Hollins College* ♦ *Hood College* ♦ *Hope College* ♦ *Huntington College* ♦

WHAT WORKS: REPORTS FROM THE CAMPUSES

To keep track of the impact of our efforts, we ask for periodic reports from teams that have been at PKAL workshops. They suggest that there are a wide range of timely activities; these reports also document the value of keeping a conversation going and of involving different constituencies within the campus community in these conversations. Here are some report excerpts:

- *We have had our first divisional meeting focused on how best to engage students in active learning, (the research-rich environment), without unnecessary redundancy and duplication of effort between departments. This was an off-campus retreat (following the advice of our workshop consultant that such time to dream away from distractions is time well spent—the dean paid for it!). We are looking at places in the curriculum where interdisciplinary courses, computerized learning and team teaching might be useful.*
- *Given all the activity on our campus on curricular matters, we have asked the dean to work with us on defining and regularizing workloads for science faculty, so we can have a clear understanding of administrative expectations during this period of change. Rethinking individual and departmental offerings, expanding our research activity and thinking about new ways to incorporate instrumentation into our research and teaching are not possible on top of everything else. We all recognize this—now, what to do about it? At least we are talking.*
- *From now on, someone from the development office will be a part of our divisional discussions about new programs. We know we need external sources of support if we are to have both the time and the equipment we want and need, and we now have in place a skeleton of a three-year plan for proposal development that will keep us on target.*
- *The first thing we did upon returning to campus, from our PKAL workshop, was to schedule a meeting with our students to find out what they thought about our courses and program.*
- *We came home from the workshop with the following questions for our departmental colleagues. These questions will serve as the agenda for several upcoming discussions:*
  - *Can a set of required courses for the major be established for annual offering, and non-science major courses then be titrated into total faculty teaching loads, or must non-science majors courses take precedence over those of majors, especially for lower enrollment upper-division courses?*
  - *Can course offerings for the major be streamlined? (We learned that ample precedent exists for a maximum 10-course requirement for the major—including laboratories.)*
  - *Should students be expected to have breadth and depth in their knowledge of science? (Currently our students can choose from a cafeteria of offerings and many select the path of least resistance.)*

Illinois Wesleyan University ♦ Indiana State University ♦ Indiana University-Bloomington ♦ Indiana University of Pennsylvania ♦ Indiana University-Purdue University Indianapolis ♦ Iona College ♦ Ithaca City School District (NY) ♦ Jacksonville University ♦ James Madison University ♦ John Carroll University ♦ Johnson C. Smith University ♦ Joliet Township High Schools (IL) ♦ Judson College ♦ Juniata College ♦ Kalamazoo College ♦ Kansas State University ♦ Keene State College ♦ Kennesaw State College ♦ Kenyon College ♦ King College ♦ King's College ♦ Knox College ♦ Kutztown University ♦ La Sierra University ♦ Lafayette College ♦ Lake Forest College ♦ Lane College ♦ Lawrence University ♦ Lees College ♦ Lewis and Clark College ♦ Lexington Community College ♦ Lima Technical College ♦ Lindsey Wilson College ♦ Linn-Benton Community College ♦ Livingstone College ♦ Los Alamos National Laboratory ♦ Louisiana State

- *Given our institutional culture of interdepartmental competition (and that our dean was at the workshop), steps are now underway to assign one faculty member to serve as coordinator and convener for the science departments. She will have the task of mediating conflicts, enhancing interdepartmental operations, managing course offerings for non-science majors, and encouraging faculty/student scholarship. She will also continue to work closely with the dean.*
- *Since we are just at the beginning of a major revision of our required courses in science for non-majors, from our workshop experience we came back determined to get a better grasp on the ways students learn and the ways in which certain activities are more appropriate than others for developing viable skills, and to try to figure out how to incorporate more discovery-based learning in our program. To be honest, some of us think it is easier to give students the answers (perhaps to questions they have not asked!) than it is to let them ask their own questions and look for answers.*
- *We have begun to explore potential affinities with other departments and programs on our campus to develop what we think will be intriguing enhancements to our program. For example, as our new library is being planned, we are considering adding a learning resources center that would enable all of us who need computers to share spaces in a cost-effective way. One thought is to have computers scattered throughout the library stacks, connected to the network and readily available to a wide range of students and faculty. This gives us a different way to think about how and where to place computers used for natural science students—that they may be in the teaching and research labs themselves, rather than in a separate computer room.*

University-Shreveport ♦ Loyola College-Maryland ♦ Loyola University ♦ Luther College ♦ Lycoming College ♦ Lyon College ♦ Macalester College ♦ Manchester College ♦ Marist College ♦ Mars Hill College ♦ Mary Washington College ♦ Maryville College ♦ McGill University ♦ McMurray University ♦ McPherson College ♦ Mesa Community College ♦ Miami University ♦ Miami University-Hamilton ♦ Miami University-Middletown ♦ Middle Tennessee State University ♦ Middlebury College ♦ Miles College ♦ Milliken University ♦ Mills College ♦ Mississippi State University ♦ Mississippi Valley State University ♦ Monroe Community College ♦ Montana Tech of the University of Montana ♦ Montclair State College ♦ Moorhead State University ♦ Moravian College ♦ Morehouse College ♦ Morgan State University ♦ Morningside College ♦ Morris Brown College ♦ Morris College ♦ Mount Holyoke College ♦ Mount Mary College ♦ Mount Saint Mary's College (CA)

FOCUSING ON FACILITIES

1992 - 1996

Meetings

Workshops on facilities planning:

- Lake Forest College: 6/92
- College of the Holy Cross: 11/92
- Kalamazoo College: 6/93
- Claremont Colleges (Joint Science Center): 10/93
- University of Richmond: 2/94
- Xavier University (LA): 3/94
- Allegheny College: 7/94
- Washington, DC: 1/95 & 12/95
- Morehouse College: 2/96

One-day seminars

- Chicago: 11/93 & 3/94
- Atlanta: 12/93
- Washington, DC: 1/94
- San Francisco: 2/95

Publications

PKAL Volume III: *Structures for Science—A Handbook on Planning Facilities* published: 12/95

"In condensed form, this handbook provides a comprehensive look at the planning and use of science facilities and, since actual examples are provided, it represents the closest thing to visiting a dozen of this nation's outstanding undergraduate science facilities. It is highly recommended for any institution planning new spaces for science."

—Workshop participant

BACKGROUND. PKAL has spent much time and energy on assisting colleges and universities in planning new spaces for their undergraduate science and mathematics programs. From the beginning, it was clear to us that a highly interactive, hands-on, experiential, lab-rich, problem-solving program—one that seeks to attract all students—needs spaces organized differently than in the past. We also recognized that on many campuses, current facilities were deteriorating, inadequate on safety and environmental as well as on pedagogical issues.

On file in the PKAL National Office are applications and follow-up materials from the 225 colleges and universities (and two private high schools) that have attended one or more PKAL facilities planning workshops. With almost $1.5 billion in projects planned or underway, the material from this small of group of institutions documents both problems and solutions. It also sends a signal about what it will cost to provide spaces that support interdisciplinary, collaborative, technological-intensive activities for undergraduate faculty and students on campuses across the country.

PKAL VOLUME III. Material from these workshops is presented in PKAL Volume III, *Structures for Science*, a 250-page handbook for planning. Just as at the workshops, the handbook presents many of the questions that need to be addressed as your planning proceeds. Some possible answers to these questions are suggested in the stories from those with recent experience with facilities projects. In the architectural case studies presented are ideas about how institutions have answered questions about purpose and design in ways fitting for their community.

Our hope is that institutions involved with PKAL facilities planning workshops arrive at facilities that work, ones that:

- clearly reflect the educational goals for science and mathematics within an overall institutional framework, for the immediate and the long-term;
- support learning that is experiential and hands-on;
- recognize the increasingly social character of scientific research and teaching by facilitating productive interaction between students and faculty;
- acknowledge the role of serendipity in the doing of science, by including spaces for exploiting the unplanned, teachable moment;
- are so inviting, safe and well-equipped that they welcome users;
- anticipate the future by providing flexibility in space and infrastructure;
- respect and reflect the community that brought them into being; and
- contribute to the humanity of the campus.

♦ *Mount Saint Mary's College (MD)* ♦ *Mount Senario College* ♦ *Mount Vernon Nazarene College* ♦ *Muskingum College* ♦ *Nazareth College of Rochester* ♦ *Nebraska Wesleyan University* ♦ *New Jersey Institute of Technology* ♦ *New School for Social Research* ♦ *New Trier High School* ♦ *Northeast Missouri State University* ♦ *Northern Arizona University* ♦ *Northern Illinois University* ♦ *Northern Kentucky University* ♦ *Northern Michigan University* ♦ *Northern New Mexico Community College* ♦ *Northland College* ♦ *Northwest Nazarene College* ♦ *Norwich University* ♦ *Oakton Community College* ♦ *Oberlin College* ♦ *Occidental College* ♦ *Oglethorpe University* ♦ *Ohio State University* ♦ *Ohio Wesleyan University* ♦ *Old Dominion University* ♦ *Oregon Institute of Technology* ♦ *Oregon State University* ♦ *Pacific Lutheran University* ♦ *Pacific University* ♦ *Pennsylvania State University Main Campus* ♦ *Pennsylvania State University at Erie-Behrend* ♦

WHAT WORKS: REPORTS FROM TEAMS

As with topical workshops, we ask participating teams to keep PKAL abreast with progress on planning new facilities. From one follow-up report:

- *Thanks. As a result of the workshop, we have reset our planning clock and will "program" our program before "programming" our square feet. We reported to the President: "The workshop focused our attention on the program elements necessary to make a convincing case (for $) for new facilities; we learned that donors are interested in supporting facilities for convincing educational programs—and that such programs derive from careful planning, build on demonstrated strengths, anticipate likely future developments and offer creative physical solutions to program needs. We could probably right now build a box around the needs we've identified to date. Or, we could take a step back and revisit program ideas. We clearly have been driven by lack of lab space, and have not considered seriously how classrooms/labs/lecture halls may change in response to new technologies and new teaching styles."*

Many institutions applying for Keck/PKAL Consultants explicitly request assistance in the process of linking programs and spaces—with a focus on the future. One consultant team made the following suggestion:

- *Think about how the facility will attract students and build a sense of community. It should be attractive on the outside as well as inside; it should articulate for the entire campus community that the study of science is vital, exciting, involves discovery and community. Spaces should account for their human occupants as well as satisfy safety considerations. It is often helpful to develop a mission statement (25 words or less) for the program; this will keep planning focused—interdisciplinary, research-rich, science for all students, etc. Having a mission statement not only has an impact on design, but can help make it easier to raise funds.*

The focus on facilities will continue to be a significant part of the work of PKAL because good spaces are critical if the current momentum in the larger effort to transform undergraduate science is to be sustained. We are looking for further examples of exciting spaces, particularly ones that anticipate the future in creative ways. We are fully aware that there are many more existing than we have captured in the handbook, and as they are brought to our attention, they will be included in a supplement to Volume III. We are also putting material from the workshops and the handbook on the PKAL Facilities Home Page.

1996

Workshops

- Duke University, Fall TBA

National Meetings

- *Facilities for the Future: What will they look like? What will they cost? How will we pay for them?* (by invitation only): Washington, DC: Fall 1996

Publications

- Supplement to PKAL Volume III, including further examples of good science facilities and expanded essays on critical planning issues. (publication 12/96—1/97)

Keck/PKAL Consultancies continue

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Focusing on Institutional Issues

1992 - 1995

Meetings/regional workshops

- Women in Science—Berea College: 10/94
- International Connections—Dickinson College: 9/93
- Art and Craft of Reform—College of the Holy Cross: /94

National Colloquia/publications

- Building the Research-rich Environment for Learning—National Academy of Sciences: 2/93. PKAL Occasional paper-Colloquium Proceedings: 4/93
- Administrative Leadership—Trinity University: 2/94
- PKAL Occasional Paper—Colloquium Proceedings: 6/94

Keck/PKAL Consultant Network Established: 6/93

As "best" is the enemy of "better," complacency is the enemy of change. Undergraduate institutions have an esteemed history of being focal points for change and innovation. But while some of the premises that underlay the earlier contributions of undergraduate colleges and universities still apply, many no longer do. The opportunity clearly lies before them to continue as leaders while mutually engaging with other players in facing the marvelous opportunities presented by the challenges of change.

—Colloquium leader

BACKGROUND. From the beginning of PKAL in 1989, we've used the kaleidoscope metaphor to emphasize that focusing on faculty, curriculum and facilities must be done from the broader perspective. All the pieces have to come together in a pattern for reform that makes institutional-sense.

A focus on institutional issues is woven into all PKAL activities:

- deans nominating faculty for F21 are asked to describe the leadership role of the candidate within the campus community and to support the career development of their F21 members;
- administrators join faculty on workshop teams in developing and implementing the plan of action emerging from workshop activities; and
- senior academic administrators have joined with national educational and scientific leaders at two PKAL Invitational Colloquia to explore issues—budgets and finance, faculty rewards, administrative leadership, collaborations, etc., that must be dealt with at the institutional level.

Strong science programs have a significant impact on the ability of the institution to attract good students and faculty; increasingly, the strength of programs in science and mathematics are seen as a measure of institutional quality.

KECK/PKAL CONSULTANT NETWORK. The most extensive of PKAL's efforts to challenge and assist institutions toward a kaleidoscopic view of reform is the Keck/PKAL Consultant Network. With support from the W.M. Keck Foundation, since 1993 colleges and universities that have sent a team to one or more PKAL workshops are eligible to apply for consultants to help keep nascent reforms moving and appropriately focused.

To this time, almost fifty colleges and universities in all parts of the country have been visited by a Keck/PKAL Consultant Team. Consultants are chosen from those involved with PKAL *Programs That Work*, presenters at PKAL workshops, and from the PKAL Leadership Committee.

Material from the Keck/PKAL Consultants Network is a rich lode of documentation about what it takes to make reforms take root and flourish at the institutional level. Reports talk about the impact of the presence or absence of administrative support and the value of the presence or absence of a clearly articulated mission. We are looking carefully at this collection of materials (original application, reports from consultants and follow-up reports from the campuses) and have begun distilling the key pieces of advice and counsel that emerge. This analysis will inform all further PKAL activities, including the large-scale effort to evaluate *institutions that work* that will lead to PKAL Volume IV.

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WHAT WORKS: REPORTS FROM A TEAM

The following excerpts are from one Keck/PKAL Consultant report. It suggests the kaleidoscopic nature of the challenges facing presidents, deans and faculty committed to reform:

- *". . . your aspirations are on target. The goals and mission statement developed in retreats the past summer are a critical first step. The recent commitment to provide additional technical staff so that faculty can reallocate their time and work more closely with students, without facing 'burn-out,' sent a good signal. We are pleased to see new line items in departmental budgets for undergraduate research and student travel, as well as for start-up costs for new faculty. We do not see in place a strategy for purchasing, maintaining and replacing scientific equipment; any multi-year plan for the sciences must include such.*

  Science education of the quality you seek to provide is expensive; however, the investment pays off both in student outcomes and in net tuition revenue. Good students want to be where it is done right. As an institution, you need to be much more aggressive in seeking external support; we recommend a faculty grants officer be appointed. There are many benefits from having such a position. She or he will serve as a link between you, your dean and the science faculty; this person can take the lead in identifying and tracking funding opportunities for faculty, nurture their creative ideas and assist them in the challenge work of preparing competitive proposals (another step toward avoiding faculty 'burn-out'). A faculty grants officer can help implement a game plan to secure necessary gifts and grants over the long-term.

  Even though you are not intending to construct a new facility until the turn of the century, start planning. Every decision you make now about curriculum, faculty hires, admissions policies, etc., ultimately will have an impact on your new spaces. The strategy should be to use the dream of a new science facility to drive broader planning; because the stakes are so high when a facility is being planned, you will be able to get the attention of the right people. This includes the non-science faculty, who need to have an active role and to become advocates for a strong science program within your institutional context. We recommend some rethinking of distribution requirements for majors, and that courses for non-majors receive priority attention in the short-term.

  Keep urging your faculty to be creative. Are there ways to reorganize people's time so that more of it goes to high priority activities? Are there ways to think creatively about budgeting to give faculty more flexibility with the same money. Finally, the students we met were as bright and interested as any we have encountered anywhere. You are clearly doing many things right.

1996

Meetings

- Assessment (by invitation)—Fort Lewis College: 1-3/8/96
- Technology (by invitation): Fall, site TBA

Publications

- Draft Working Outline PKAL Volume IV: *Patterns of Reform-Institutions That Work*

Keck/PKAL Consultant Network:

- Application deadline for Round 4: 5/1/96
- Application Deadline for Round 5: 10/1/96 (anticipated)

PKAL Evaluation Site Visits to Selected Institutions

Spelman College ♦ Stetson University ♦ Stillman College ♦ Susquehanna University ♦ Swarthmore College ♦ Talladega College ♦ Texas A & M University ♦ Texas College ♦ Texas Wesleyan University ♦ The Claremont Colleges ♦ The Colorado College ♦ The University of the South ♦ Tougaloo College ♦ Towson State University ♦ Trinity Christian College ♦ Trinity College (CT) ♦ Trinity College (DC) ♦ Trinity College of Vermont ♦ Trinity University ♦ Troy State University in Montgomery ♦ Tulane University ♦ Tuskegee University ♦ Union College ♦ Union College (KY) ♦ Universidad Metropolitana (P.R.) ♦ University of Akron ♦ University of Alabama ♦ University of Arizona ♦ University of Arkansas ♦ University of California Medical Center ♦ University of California-Berkeley ♦ University of California-Davis ♦ University of California-Los Angeles ♦ University of Canberra ♦ University of Central Arkansas ♦ University of Central Oklahoma ♦ University

1992 - 1996

PKAL has connected with:

- American Chemical Society
- Association of American Colleges and Universities
- American Society for Microbiology
- American Society of Cell Biology
- Association for Women in Science
- Chemlinks (An NSF-funded Chemistry Initiative)
- Council on Undergraduate Research
- The Association of Higher Education Physical Plant Officers (APPA)
- National Research Council—Committee on Science Education
- National Science Foundation—Undergraduate RevUe
- Project NEXT
- Society for Integrative and Comparative Biology
- United Negro College Fund

"All (most?) of us have access to research funds and go off to scientific meetings where our imaginations are stimulated about the behavior of nature. Yet, each of us wears at least two hats: researcher and teacher. There is, in general, no forum provided by institutions for the stimulation and reinvigoration of teachers as scholars. PKAL provides the time and the respectability for devoting effort to pedagogical concerns. It is a worthy effort."

—Workshop presenter/university faculty member

BACKGROUND. Nothing happens in a vacuum, and these past few years have been interesting ones for those with a stake in a strong undergraduate community. The PKAL network includes only part of those actively transforming undergraduate science programs—on single campuses and through new kinds of collaborative efforts. The list of individuals, institutions, and associations taking up the cause is long and growing. PKAL has been pleased to connect to some of these; we are grateful for support from the NSF, FIPSE, and other funders that helped make these connections.

The primary question for us is not "is a strong undergraduate science community in the national interest?" Most of us answered that question "yes" many years ago; we are confirmed in this judgement as we read daily papers and think about the kind of scientific sensibility it takes to understand what is going on in our world; as we listen to governors discuss goals for the K-12 communities in their states and business leaders talk about what kind of skills and understandings they want in their employees; when we realize how much more exploration and discovery lies ahead—in space, on diseases, and on sustaining quality life for all living things—and as we realize that for many the undergraduate years are their last opportunity for rigorous engagement with science and mathematics.

The questions now are: "do we have the *collective will* to pursue and achieve a vision of an undergraduate science community that truly serves the national interest? Can we afford to do this? Can we afford not to?"

CONTEXT. The issues underlying these questions call for response at the local level as well as at the national; they transcend the concerns and work of any single organization. To address them in a systematic manner, new kinds of strategic alliances need to be built and sustained: those within and between campuses *and* between the higher education and the K-12 community. In particular, such alliances must engage individuals who bring to the task a national perspective, including college and university presidents, deans, and science faculty, governing boards, representatives of federal and state agencies, private foundations and scientific and educational associations. The issues these alliances will be considering are not the same as those confronting the nation during the Sputnik era, or even as recently as ten years ago. For example, instructional programs that focused only on educating the next generation of research scientists are different from those that have a goal of *science for all students*, the citizens and workforce of the future.

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ISSUES. There are many issues important to PKAL that reflect and are influenced by the current national dialogue about undergraduate science education. In the coming months—in workshops and PKAL networks, and with allies—we will be working on defining these issues so that an agenda for action can proceed more effectively. This includes giving attention to:

- defining carefully what we mean when we talk about integrating *research and teaching*, or *research and education;* as language shapes action, a clear definition here would help graduate students prepare to become scholars in the full sense of the term. It would also help faculty at all career stages to determine how to shape their work in classroom and lab: to know what and how to teach, how students learn; to use information technologies and build facilities most productively; and to build supportive networks of persons with similar commitments and convictions.
- defining *learning outcomes* is also critical: as the K-12 and undergraduate community learns to work together; as students come to our campuses with different levels of preparation and career aspirations; as faculty struggle with what students really need to know about the content and process of science; as everyone seeks to make the most creative and effective use of new technologies and pedagogical approaches; and as the ability to live a productive and fulfilled life increasingly requires some scientific and technological capacities.

We would also like to document more completely the efficacy of the theories and practices in strong undergraduate programs that have been developed during the past decade.

For example:

- institutions reporting to PKAL make clear the relationship between quality spaces and programs: the impact of good facilities on their ability to attract strong students, first-rate faculty, or implement inquiry-based programs that bring more students into the sciences. We intend to move beyond anecdotal reports and get clear data on this.
- we also intend to develop benchmarks of quality for *institutions that work*, building on insights from Keck/PKAL consultancies, PKAL Programs that Work, other reports from the PKAL campuses, and from materials gathered by others.

Finally, we'd like to explore the issue of dissemination—*what works* in sharing ideas and experiences, in transferring ownership of effective practices from one setting to another.

Coming to clarity in this defining and documenting is essential if programs—at the local, state, and national level—are to be developed and implemented to make best use of limited resources. This is a critical time; we cannot lose the momentum of the past few years. The energy and money spent on the continued effort to transform undergraduate science is an investment in the future.

An old French proverb says: "*the future belongs to those who build bridges.*" Although PKAL has its roots in the liberal arts community, as our work proceeded, we quickly realized the critical need for such bridges. At the 1991 PKAL National Colloquium, Congressman George E. Brown said: "*we must collaborate. The time is too short and the task too great to do otherwise.*" So, on with the task.

1996

Ongoing activities:

- Faculty21: 1996 Faculty21 National Assembly: "Exploration and Discovery—Charting a Career as Scholar and Leader." F21 Deans Dialogue
- PKAL Workshops on Curricular Issues
- PKAL Workshops on Facilities Planning
- Keck/PKAL Consultancies
- PKAL Internet and World Wide Web

New emphases/activities:

- Faculty21 Visiting Scholar Program. (Short-term visit/exchange opportunities)
- PKAL Workshops on Institutional Issues. (assessment, technology, international, etc.)
- Web "Home Pages" for each PKAL workshop.
- Invitational Colloquium on "*Facilities for the Future*"
- Supplement to Volume III.
- Volume IV: *Institutions that Work: Patterns for Reform*
- Advisory Task Force on *Leadership and National Issues*

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J. Laurie Snell—*Dartmouth College*
Patti Soderberg—*Beloit College*
Paul Sotherland—*Kalamazoo College*
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John R. Strassburger—*Ursinus College*
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Keith Stroyan—*University of Iowa*
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Warfield Teague—*Hendrix College*
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Roger D. K. Thomas—*Franklin & Marshall College*
Albert N. Thompson Jr.—*Spelman College*
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Charles S. Weiss—*College of the Holy Cross*
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Richard A. White—*Duke University*
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PKAL STAFF

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Noel Petit, Internet Manager

PKAL Scientist-in-Residence:

Judy Dilts—William Jewell College, 1994, 1995
Edward Kisailus—Canisius College, 1994
Julie Monson—Consultant, 1994
Jim Gentile—Hope College, 1993

PKAL Faculty21 Scientist-in-Residence:

Walter Seaman—University of Iowa, 1995

KEY

♦ = Leadership Committee Member
● = Keck Consultant
\+ = Leadership Committee and/or Keck Consultant who has also served as a Workshop Presenter

All other people listed served as Workshop Presenters

PKAL INTERNET

1992 - 1995

Since 1992, PKAL has maintained a server through Augsburg College, which provides service for the PKAL World Wide Web and Gopher sites, and PKAL e-mail lists

PKAL World Wide Web and Gopher:

http://www.augsburg.edu

- Access by users around the world has increased steadily since 1992. The PKAL site now registers an average of over 6500 files accessed per day
- Contains materials and links to resources gathered from PKAL Workshops and activities. Includes presenter talks and papers, participant posters, team reports, and photographs
- Maintains home pages for over 80 Faculty21 members and provides links to home pages at other institutions

PKAL E-mail:

- With a total of over 1,350 users, distributes general announcements, as well as PKAL Workshop and Program information
- Maintains over 35 e-mail lists, developed from workshop participants, presenters and leaders, which enable post-workshop conversation and world-wide connections

THE PKAL INTERNET LINK facilitates the exchange of ideas, expanding beyond the limits of time and space, to create a national and international community committed to and equipped for reform. Through the use of advancing technology, PKAL has established a communication network that allows people from all over the world to be involved in conversations on what works in undergraduate SME&T education. The PKAL Internet Link includes PKAL World Wide Web and Gopher sites, as well as established e-mail families.

THE PKAL WORLD WIDE WEB AND GOPHER sites contain hundreds of documents relating to the reform of undergraduate science and mathematics programs, including:

- schedules of upcoming PKAL events;
- essays and papers from important leaders in the PKAL community;
- materials from past workshops, such as agendas, presenter talks, posters, team statements and reports, photographs; and
- links to other organizations and institutions on the Internet that have similar interests and are a helpful resource for reform.

E-mail families are actively used to disseminate information on all PKAL activities, as well as to provide a forum for PKAL members to discuss pertinent topics. Some of the most important uses of the PKAL e-mail families are to:

- distribute general announcements on PKAL programs such as the Keck/PKAL Consultant Network and *Programs That Work*.
- announce PKAL Workshops, application procedures and deadlines, and logistics.
- send weekly messages to Faculty21 members on issues important to the preparation of young faculty for their role in the reform effort.
- maintain an ongoing Faculty21 Deans conversation, which discusses issues important to the development and preparation of young faculty for their role in the reform effort.

OUR VISIONS FOR THE FUTURE of the PKAL Internet Link are to use Internet technology to enable the expansion of an increasingly cohesive community dedicated to reforming undergraduate SME&T education. Expanding access to the internet and advancing technologies in software and hardware will help to sustain and nurture the conversations PKAL has begun; it will also encourage the growth of the PKAL audience and enrich the dialogue of an ever-increasing community.

College ♦ Washington College ♦ Washington County Technical College ♦ Washington State University ♦ Washington and Jefferson College ♦ Washington and Lee University ♦ Waynesburg College ♦ Wellesley College ♦ Wesleyan College ♦ West Chester University ♦ West Virginia Wesleyan College ♦ Western Oregon State College ♦ Western State College ♦ Western Washington University ♦ Westmont College ♦ Wheaton College ♦ Wheeling Jesuit College ♦ Whitworth College ♦ Wichita State University ♦ Willamette University ♦ William Jewell College ♦ Williams College ♦ Winona State University ♦ Wisconsin Lutheran College ♦ Wittenberg University ♦ Wofford College ♦ Worcester Public Schools (MA) ♦ Xavier University ♦ Xavier University of Louisiana

♦ ♦ ♦

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Stop by PKAL's HomePage at:

http://www.augsburg.edu

♦ ♦ ♦

1996 DEADLINES (as of April 15)

Applications for ***Keck/PKAL Consultant Team*** ..... May 1

Applications for ***The Research-Rich Environment Workshop*** at Hope College ..... April 12

Nominations for the ***F21 Class of '96*** ..... June 1

Applications to participate in ***PKAL Assessment Meeting*** ..... June 20

Applications for ***Introductory Mathematics Workshop*** at the University of Iowa ..... June 21

Applications for the ***Science for all Students Workshop*** at St. John's College-Santa Fe ..... June 28

Applications for the ***National Assembly: F21 Classes of '94 & '95*** ..... July 1

Applications for the ***Under-represented Minorities Workshop*** at Fort Lewis College ..... July 5

Nominations for PKAL ***Programs that Work*** ..... July 15

Applications for the ***Interdisciplinary/Environmental Studies Workshop*** at Colby College ..... September 15

Applications for the ***Introductory Physics Workshop*** at Louisiana State University ..... October 18

FOR MORE INFORMATION ON THE ABOVE, VISIT THE PKAL HOMEPAGE AT http://www.augsburg.edu

♦ *Keep in Touch With PKAL* ♦

Please complete the information below if you would like to be added to the PKAL database or if you have information to update.

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☐ PKAL Volume III: *Structures for Science*

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